The Site Operations Work Plan for the BOMARC Missile Site Plutonium Remediation at McGuire AFB, NJ

Prepared by:

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Commercial Operations
628 Gallaher Road
Kingston, Tennessee 37763

for

AIR MOBILITY COMMAND
Scott AFB, Illinois 62225-5022

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LIST OF ACRONYMS

AFB	Air Force Base
ABIH	American Board of Industrial Hygiene
ACGIH	American Conference of Governmental Industrial Hygienists
AEA	Atomic Energy Act
AEC	Atomic Energy Commission
AF	Air Force
AFI	air force instructions
AHA	Activity Hazard Analysis
ALARA	as low as reasonably achievable
AMC	Army Material Command
ANSI	American National Standards Institute
APR	air purifying respirator
AR	army regulations
ARAR	applicable, relevant and appropriate requirements
ASME	American Society of Mechanical Engineers
ASTM	American society for testing and materials
ATSDR	Agency for Toxic Substances and Disease Registry
BOMARC	Boeing Michigan Aeronautical Research Center
BROKER	hazardous material broker
BZ	breathing zone
Ca	carcinogenic
Ci	Curie
CAA	Clean Air Act
CAA	controlled access area
Capt	captain (air force)
CAPT	captain (navy)
CBC	complete blood count
CDE	committed dose equivalent
CDR	commander
CEDE	committed effective dose equivalent
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
CGI	combustible gas indicator
CHP	Certified Health Physicist
CIH	Certified Industrial Hygienist
CM	construction manager
CMP	corrugated metal pipe
CNS	central nervous system
COC	chain of custody
COC	contaminant of concern
CPM	counts per minute

LIST OF ACRONYMS

(CONTINUED)

CPR	cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
DAC	derived air concentration
DARA	Department of the Army Radioactive Material Authorization
dB	decibel
DCF	dose conversion factor
DCGL	derived concentration guideline level
$DCGL_{emc}$	derived concentration guideline level, elevated measurement comparison
$DCGL_W$	derived concentration guideline level, wilcoxon rank sum test
Decon	decontamination
DEFT	decision error feasibility trails
DLC	data life cycle
DMP	Drainage Ditch Corrugated Metal Pipe
DOD	Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQA	data quality assessment
DQOS	data quality objectives
EERF	Eastern Environmental Radiation Facility
EG&G	EG&G Ortec, Inc.
Ehf	human factors efficiency
EKG	electrocardiogram
EMC	elevated measurement comparison
EML	Environmental Measurements Laboratory
EMMI	environmental monitoring methods index
EMS	Emergency Medical Service
EPA	U.S. Environmental Protection Agency
EPIC	environmental photographic interpretation center
ERAMS	environmental radiation ambient monitoring system
eV	electron volt
EZ	exclusion zone
FEMA	Federal Emergency Management Agency
FID	flame ionization detector
FIDLER	field instrument for the detection of low energy radiation
FIRM	flood insurance rate maps
FRDS	federal reporting data system
FSP	field sampling plan
FSS	final status survey
FWPCA	Federal Water Pollution Control Act
G	gram
GEMS	geographical exposure modeling system
GERT	General Employee Radiation Training
GET	General Employee Training

LIST OF ACRONYMS

(CONTINUED)

GFCI	ground fault circuit interrupter
GM	Geiger-Mueller
GPS	global positioning system
GRIDS	geographic resources information data system
GSA	General Services Administration
GWSI	ground water site inventory
Ha	alternative hypothesis (a)
HASP	Health and Safety Plan
HAZWOPER	OSHA Hazardous Waste Operations
HCL	hydrochloric acid
HEPA	High Efficiency Particulate Air
Ho	null hypothesis zero
HP	Health Physicist
HPGE	high purity germanium
HPT	Health Physics Technician
HSA	Historical Site Assessment
HSWA	Hazardous and Solid Waste Amendments
HTRW	Hazardous, Toxic, and Radioactive Waste
IATA	International Air Transport Association
IDLH	immediately dangerous to life and health
IDW	investigation derived wastes
IP	ionization potential
ISI	information system inventory
LBGR	lower bound of the gray region
Lc	critical level
L_D	detection limit
LEL	lower explosive limit
LLRW	low level radioactive waste
LLRWPA	Low Level Radioactive Waste Policy Act
LO/TO	lockout/tagout
LR	launch room
LRC	launch room ceiling
LSA	low specific activity
LT	lieutenant
MARLAP	Multi-Agency Radiation Laboratory Analytical Protocols
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCA	multi-channel analyzer
MDC	minimum detectable concentration
MDCR	minimum detectable count rate
MeV	million electron volts
MSDS	material safety data sheet
MW	mixed waste
NAES	Naval Air Engineering Station (Lakehurst)
NaI	sodium iodide
NCAPS	National Corrective Action Prioritization System

LIST OF ACRONYMS

(CONTINUED)

nCi	nanocurie
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NORM	naturally occurring radioactive material
NPDC	National Planning Data Corporation
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRR	noise reduction rating
NWPA	Nuclear Waste Policy Act
NWWA	National Water Well Association
ODES	ocean data evaluation system
OSC	Operations Support Command
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbons
pCi	picocurie
PEL	permissible exposure limit
PERALS	photon electron rejecting alpha liquid scintillator
PIC	pressurized ionization chamber
PID	photo ionization detector
Plan	site operations Work Plan
PM	project manager
PPE	personal protective equipment
PRG	preliminary remediation goals
QA	quality assurance
QAMP	quality assurance management plan
QAPP	quality assurance project plan
QC	quality control
QMP	quality management plan
RAGS/HHEM	Risk Assessment Guidance for Superfund/Human Health Evaluation Manual
RASP	Radiological Affairs Support Program
RC	release criterion
RCA	radiological control area
RCRA	Resource Conservation and Recovery Act
RCRIS	Resource Conservation and Recovery Information System
RCT	Radiological Control Technician
REL	Recommended Exposure Limit
REM	roentgen-equivalent-man
RI/FS	Remedial Investigation/Feasibility Study
RMSD	root mean square deviation
ROD	Record of Decision
RPD	relative percentage difference
RPP	Radiation Protection Plan
RSM	radioactive shipment manifest

LIST OF ACRONYMS

(CONTINUED)

RSSI	radiation survey and site investigation
RWP	radiation work permit
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCO	surface contaminated object
SDWA	Safe Drinking Water Act
SFMP	Surplus Facilities Management Program
SI	international system of units
SMAC	Sequential Multiple Analyzer Computer Profile
SOP	standard operating procedure
SRD	self-reading dosimeter
SSHO	Site Safety and Health Officer
STEL	short-term exposure limit
STORET	storage and retrieval of U.S. waterways parametric data
Sv	sievert
TEDE	total effective dose equivalent
TLD	thermoluminescent dosimeter
TLV	threshold limit value
TRU	transuranic
TSA	technical systems audit
TSCA	Toxic Substances Control Act
TWA	time-weighted average
UL	Underwriters Laboratories
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USCS	unified soil classification system
USDOT	U.S. Department of Transportation
USGS	United States Geological Survey
USNRC	U.S. Nuclear Regulatory Commission
USPHS	United States Public Health Service
USRADS	ultrasonic ranging and data system
VOC	volatile organic compound
WATSTORE	National Water Data Storage and Retrieval System
WGP	weapons grade plutonium
WL	working level
WRS	Wilcoxon Rank Sum

1.0 PURPOSE

The Site Operations Work Plan (Plan) for the BOMARC Missile Site Plutonium Remediation at McGuire AFB, NJ is the guide used for all work associated with the BOMARC Missile Site Plutonium Remediation Project. Its purpose is for the safe, effective, and efficient execution of the work. The work activities and the duration are given in the Project Schedule, Appendix E. The Plan ensures compliance with local, state and federal regulatory requirements.

The Scope of Work covered by the Plan is the excavation of soil above 8 pCi/g total plutonium and dismantling of structures contaminated with plutonium above the BOMARC site release criteria. The project will use Am-241 as a surrogate for plutonium activity since it is easier to measure than plutonium. The predicted surrogate value for clean up is 1.5 pCi/g Am-241, based on a Pu-239/240 to Am-241 ratio of 5.4 to 1. The waste will be packaged and transported to an appropriate licensed off-site disposal facility. The highest regard will be given to the safety of the workers and public. Environmental integrity will be maintained throughout the project.

The Plan elements cover the quality expectations of the project, particularly with respect to contamination survey analysis and adherence to the site release criteria.

1.1 Background

The BOMARC facility occupies approximately 218 acres just east of Ocean County route 539 in Plumsted Township, Ocean County, New Jersey. The facility is approximately 11 road miles east of McGuire AFB and is contained within the Fort Dix Military Reservation on land permitted to the Air Force.

The Air Force built rows of shelters to house nuclear warhead equipped BOMARC missiles at this facility during the 1950s and 1960s. The Air Force deactivated the facility in 1972 after they removed all missiles from the shelters. Although the facility is inactive, it remains under Air Force jurisdiction.

On June 7, 1960, an explosion and fire occurred in BOMARC Missile Shelter 204. The force of the explosion destroyed portions of the shelter roof, causing flames to rise to 20 feet, and caused black smoke to blanket the area. Initially, the fire burned uninhibited for about 30 minutes. Firefighters sprayed the area with water from fire hoses for approximately 15 hours as part of the fire-fighting activities. As a result, plutonium-contaminated water flowed under the front door of Missile Shelter 204, down the asphalt apron and street, and into the drainage ditch leading outside the site boundary. At one point during fire-fighting efforts, responding personnel constructed an earthen dam across the ditch to contain the contaminated water. The drainage ditch runs in a southerly direction from Shelter 204 and parallels the site boundary fence for

several hundred feet before it enters a series of underground culverts and eventually crosses underneath Ocean County Route 539. From this point, the culvert opens into a sandy ditch that eventually flattens into a wooded area.

Although no nuclear explosion took place, the nuclear warhead, which contained plutonium, enriched uranium, and bottled tritium, burned and partially melted. The fire destroyed the missile and badly damaged the missile shelter. The explosion displaced the oxidizer tank, yet it remained intact. Residue from the burning warhead contaminated the concrete floor. In addition to the severely damaged roof, flying fragments of the helium and fuel tanks pitted the floor and concrete walls. The accident also deformed the steel roof beams and caused heat damage to the shelter walls.

Air Force procedures in effect at the time of the accident included removal of contaminated debris from the shelter for disposal as waste. Existing records indicate that additional radioactive waste from the site was disposed at the Idaho National Engineering and Environmental Laboratory. Records also indicate that they applied containment measures to the missile shelter and the asphalt apron.

During the fire, tar had melted and spread in a thin layer onto sections of the floor of Shelter 204. Several sections of the floor containing tar showed alpha radiation readings of over two million counts per minute (cpm). Alpha radiation levels in the center of the road outside the shelter were also two million cpm. The Air Force again washed down the entire area with water and then allowed it to dry. Presumably, the wash water drained into the drainage ditch.

After the area was completely dry, they spray painted the inside of the shelter to immobilize the radiation emitting contaminant. They also painted the outside area. After the paint had dried enough to walk on, they took radioactivity readings again. Areas that had previously shown 2,000,000 cpm then showed 0 cpm, due to the shielding effect of the paint layer on the plutonium. Some of the fringe areas, however, showed readings ranging from 50 to 500 cpm.

Shortly after the 1960 missile accident, explosive ordnance personnel recovered seven containers of plutonium. The DOE conducted measurements of the recovered material. The amount of plutonium in the warhead remains classified. However, DOE and Air Force scientists prepared an unclassified account of the disposition of the recovered material during that period. The account indicates that the estimate of the upper limit of the plutonium that could be on-site is 300 grams. A characterization study completed in 1997 supported this conclusion.

Later in June 1960, the Air Force poured 4 inches of reinforced concrete over the asphalt apron in front of Shelter 204 to fix the plutonium

contamination under a protective overburden. In addition, they placed 2 inches of asphalt along the bottom of the drainage ditch located inside the site boundary fence and added an additional 2 inches of concrete to a small portion of the shelter apron area in 1967. They filled the pit area inside Shelter 204 with soil excavated from the rear of the shelter.

1.2 Project Organization and Key Personnel

The project will be managed by an organization led by a Project Manager, and a Construction Manager that are supported by a Project Team of field and home office personnel and key subcontractors.

The goals of the Project Team are to provide responsible and responsive assurance that safety and quality standards, technical management, effective cost and schedule control, and effective communication with the Operations Support Command (OSC) are met for this remediation effort. To meet these goals, the project organization will implement the following features:

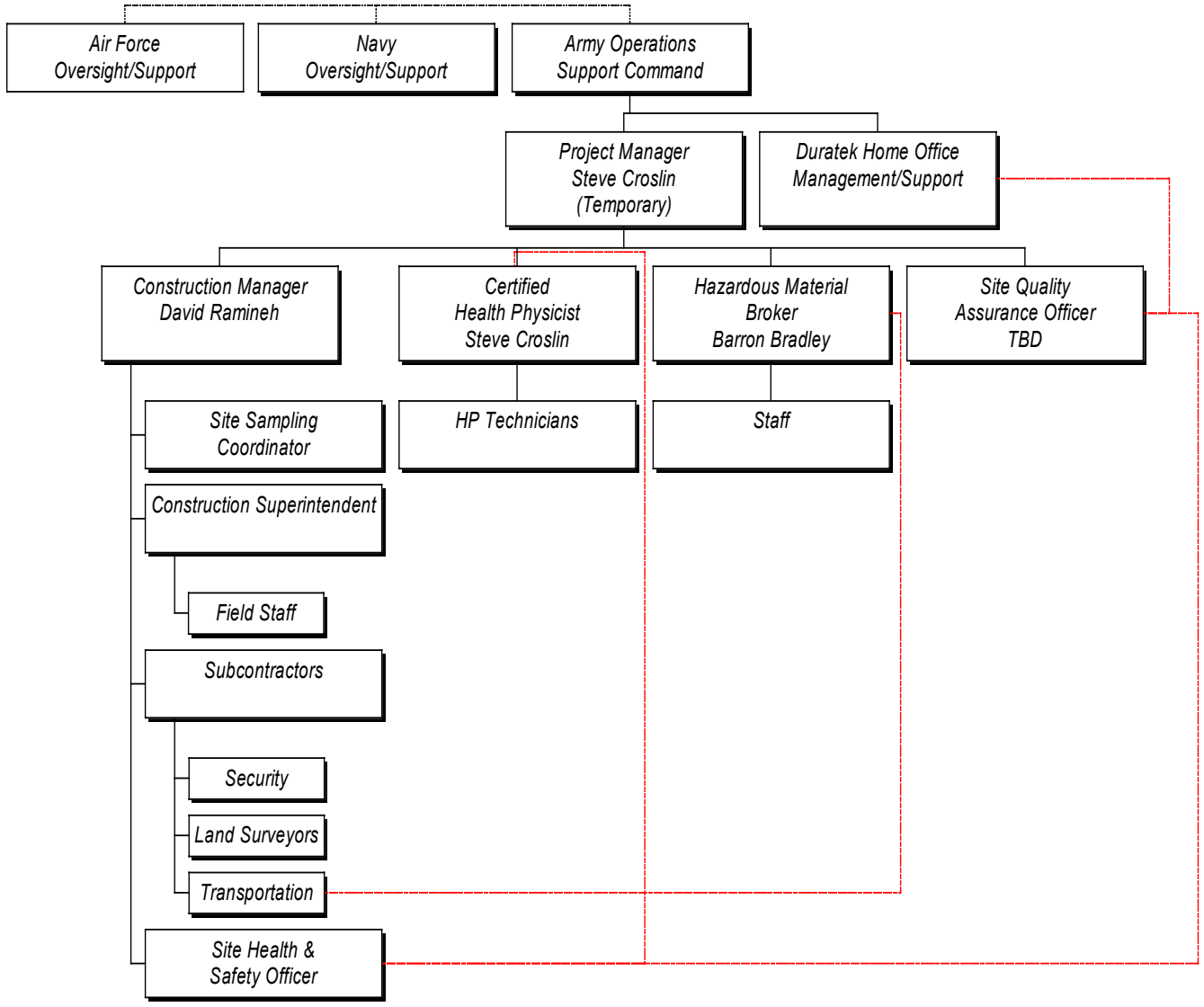
- Independent quality assurance and safety reviews and audits to insure that the project Safety and Quality Assurance goals are met,
- Direct reporting and technical supervision among the various components, with clearly defined project control responsibilities and authorities,
- Experienced and qualified key technical personnel assigned to major work elements and
- Direct interaction of project technical personnel with the OSC, the Air Force, the Army and the Navy.

The project organization and key personnel that will be employed in performing the BOMARC Remedial Action are depicted on Figure 1-1.

As a pre-condition for assignment to the Site, all Site workers will be 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations (HAZWOPER) certified and will be covered under medical monitoring programs meeting 29 Code of Federal Regulations (CFR) 1910.120. General employee radiation training and associated radiological monitoring will be handled as site-specific activities, as specified in the Radiation Protection Plan (Appendix B).

Figure 1.1

BOMARC Missile Site Plutonium Remediation Project
Site Organization Plan



A description of overall duties and responsibilities by major functional work area follows:

1.2.1 Project Manager

The Project Manager (PM) is responsible for the overall safety, coordination and direction of the remediation effort. He will serve as the principal point of contact with the OSC project organization. The PM is responsible for overall health, safety, regulatory compliance, quality, schedule and cost control, project staffing and employee relations, subcontractor approval, and management and direction.

1.2.2 Construction Manager

Remediation construction activities consisting of mobilization, environmental protective activities, remediation activities and operations (i.e., excavation, dismantling, waste transportation, etc.) will be under the day-to-day management of the Construction Manager (CM). The CM will report to the PM. For remediation operations, he will be directly responsible for each of the following major functional areas:

- The CM will directly oversee mobilization activities with support from construction technicians,
- Excavation and material management consisting of excavation stockpiles (i.e., >8 pCi/g and <8 pCi/g Pu 239/240 soils) and shelter debris from demolition, soil weighing and load-out into intermodal containers, backfill of excavated areas and their restoration,
- Loading, packaging, and transportation of waste materials to the railhead area,
- Environmental Control Systems, Decontamination Operations, and Maintenance including water and dust control systems, non-personnel decontamination operations (i.e., equipment, debris, roads, etc.), facilities, security and equipment maintenance.

1.2.3 Site Certified Health Physicist

The Site Certified Health Physicist (CHP) will be responsible for day-to-day compliance monitoring of the approved Health and Safety Plan (HASP) (Appendix A) with emphasis on the Radiation Protection Plan (Appendix B). Specific tasks include site-specific personnel training, maintenance of the medical monitoring program, personal protective equipment (PPE), respiratory protection and decontamination operations, and operations support to the on-site

construction work force. The CHP is the site safety representative, who will report to the PM while having direct lines of communications to the Home Office.

1.2.4 Site Sample Coordinator

The Site Sample Coordinator will be responsible for the day-to-day direction and oversight of the BOMARC on-site laboratory operations, radiological and non-radiological sampling, and surveying support services. He will directly oversee the majority of the activities during the mobilization phase of the project. The Site Sample Coordinator will collect samples under the guidance of the CHP and will report to the CM. For remediation operations, on-site staff in each of the following major functional areas will support him:

- Laboratory Operations, which consist of maintenance of the air and water monitoring programs, real time soil scanning in support of the excavation and material stockpile operations, on-site laboratory analysis for waste shipments,
- Radiation control both within and outside designated exclusion zones,
- Final Status Survey sampling,
- Off-site laboratory analysis coordination,
- Facilities and equipment radiological monitoring,
- Engineering for the establishment and maintenance of the Site coordinate system, land surveying (i.e., property boundaries, pre-and post-excavation limits, and post-restoration), inspection and testing support,
- Regulatory compliance monitoring, and
- Records maintenance and transfer to the Site QA Officer.

1.2.5 Hazardous Material Broker

The Hazardous Material Broker (Broker) provides on-site knowledge in the packaging, transportation, and disposal of low-level radioactive and certain hazardous wastes. The Broker will assist the generator in ensuring that the packaged waste complies with federal, state, and burial site requirements, including 10 CFR Part 61, 10 CFR Part 71 (NRC transportation regulations) and 49 CFR Parts 100-177 (DOT transportation regulations). The Broker will report to the CM. The Broker has experience in shipping radiological waste and will provide the project with the following services:

- Provide guidance concerning physical and radiological surveys of packages to ensure compliance with U.S. Department of Transportation (US DOT) and U.S. Nuclear Regulatory

Commission (US NRC) shipping regulations, including marking, labeling, and waste classification,

- Complete final shipping papers for public conveyance to ensure compliance with applicable federal, state, and disposal site regulations,
- Assistance in completing prior notification forms and permit applications, as well as making timely prior notifications to state, federal and other regulatory agencies, as required,
- Ensuring proper loading, bracing, marking, labeling, and surveys of radioactive material shipments from the railhead,
- Radiological inspection of the loaded rail cars to ensure compliance with the Work Plan, US DOT, US NRC, and OSC shipping regulations and
- Consulting services prior to shipping to ensure on-site activities are efficient and effective.

1.2.6 Site Quality Assurance Officer

The Site Quality Assurance Officer (QA) will be responsible for day-to-day monitoring, surveillance and inspection to verify compliance with the Plan and its Appendices, including records filing and archiving. The QA Officer will report to the PM.

1.2.7 Home Office Support

Home Office support staff will be temporarily assigned to the project on an as-needed basis and will consist of safety professionals, regulatory affairs personnel, engineers, scientists and technical specialists.

1.2.8 Subcontractors

Subcontractor services are presently anticipated for the site surveying (topography, site survey, etc) during the mobilization phase of the project. Subcontractors' services during remedial operations will include land surveying, off-site laboratory analyses, waste transportation, on-site laboratory operations, security, and radiation control technicians.

2.0 REFERENCES

2.1 10 CFR Part 61 and Part 71, NRC Transportation Regulations,

2.2 29 CFR Part 1910.120 and 1200, and Part 1926 Occupational Safety and Health Administration,

2.3 49 CFR Parts 100-185, DOT Transportation Regulations,

2.4 CNS Procedure, CN-AD-005, First Notification Procedure,

2.5 CNS Procedure, CN-EM-002, CNS Transportation Emergency Response Plan,

2.6 CNS Procedure, QA-AD-001, Quality Assurance Program,

2.7 NRC Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors,

2.8 NJDEP, 1987, Guidelines for Soil Erosion and Sediment Control,

2.9 USACE, 1997, Radiation Protection Manual, EM385-1-80, May 1997,

2.10 USACE, 1997, Guidance for Low Level Radioactive Waste (LLRW) and Mixed Waste (MW) Treatment and Handling, EM 385-1-80. Prepared by U. S. Army Corps of Engineers (USACE), Washington, D.C. 30 Jun 1997,

2.11 USACE, 1996, Chemical Data Quality Management for Hazardous, Toxic and Radioactive Waste Remediation Activities, EM 1110-1-263. Prepared by U. S. Army Corps of Engineers (USACE), Washington, D.C. 1 April 1996,

2.12 United States Air Force, November 1992, Record of Decision, BOMARC Missile Accident Site, McGuire Air Force Base, New Jersey,

2.13 USEPA, 1997, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), EPA 402-R-97-016 (NUREG-1575). DOD, DOE, NRC, USEPA. December 1997.

3.0 SITE CONSTRUCTION ACTIVITIES

3.1 Construction Mobilization and Training

Major construction items, which will be installed in support of remediation operations, are summarized in this section of the Plan.

Mobilization includes procurement and installation of necessary facilities, equipment, and materials to perform the Remedial Action. Mobilization activities also include the assignment of personnel to the job site; personnel radiation safety and site-specific construction safety training; task-specific training; and regulatory permitting and notifications, as required.

Site-specific radiological and general site training will be provided for all employees at the commencement of the project. Health and safety training details are provided in the Site Health and Safety Plan (HASP) (Appendix A). Site personnel training certification and its documentation

will be maintained by the Site QA Officer with copies submitted to the OSC.

3.2 Site Layout and Temporary Facilities

The Site Layout includes all directions and drawings required for preparing the BOMARC Project Site and the railhead area for the remedial action (i.e., construction of railhead facilities, excavation, backfill, Transportation and Disposal of material and waste, and site restoration). Detailed drawings can be found in Appendix F. The General Site Layout is provided in Drawing 799147-C1.

3.2.1 Site Access and Security

The Construction Manager is responsible for security and access to the BOMARC site and the railhead location, with the assistance of subcontractor security personnel. Access to the BOMARC Site will be restricted by fences and locked gates. BOMARC Site access will be controlled by an existing security gate or by on-site personnel during operational hours. A security guard will be present during all other times. A temporary guard shack will be placed at the existing site entrance, and 24-hour security will be provided at the BOMARC site for the duration of the project.

The railhead area will be posted as a controlled access area and entry will be restricted to personnel with a need to enter the area. These precautions are primarily to prevent unauthorized personnel from entering the area while work is being performed or when waste is stored in the area. In addition, the contractor will arrange for 24-hour security at the rail loading area whenever rail cars with radioactive waste are at the site and no other contractor personnel are at the rail loading area. At no time will the contractor leave radioactive waste at the railhead unattended.

The contractor will be issued keys for the Route 539 Gate, the Hancock Road Gate and the rail spur gate at NAES Lakehurst. The contractor will be responsible for access control at these gates and will ensure that the gates are locked when unattended. The gates will only be opened to allow the movement of materials, personnel or equipment used in the project (e.g., rail car movement, truck access, and personnel access).

3.2.1.1 Contractor personnel or contracted security personnel will attend waste (contaminated soil and building debris) removed from the ground or from demolished structures at all times until the waste reaches the main line of the railroad.

3.2.1.2 Contracted, unarmed guards will provide 24-hour security, during hours when contractor personnel are not

present. Security guards will have communications provided by cellular phone and portable hand-held radios, if supplied by NAES Lakehurst, for communication with Navy security personnel.

3.2.1.3 All on-site contractor personnel and subcontractors will be issued identification badges for the duration of the project.

3.2.1.4 In the event of a public disturbance or trespassing, which affects the removal or transport of the waste, contractor personnel or contracted security personnel will request assistance from the security force with jurisdiction

- BOMARC property – McGuire AFB security, 911
- Fort Dix property- Fort Dix security, 911
- NAES Lakehurst- NAES Lakehurst security, 911
- Adjoining non-federal property – Ocean County Sheriff Department, 911

3.2.1.5 McGuire AFB will provide backup security for other security forces, if needed.

3.2.1.6 After calling for security assistance, contractor personnel or contracted security personnel will notify the Duratek Project Manager. The Duratek Project Manager will notify the Air Force Project Manager, and the installation managers at NAES Lakehurst and Fort Dix.

3.2.2 Utilities and Connection Points

Utilities are required for the completion of the remedial action activities. Due to the lack of utility connections within the BOMARC facility, utilities will be provided by onsite equipment. A 40 kW generator will supply electric power to the Laboratory/Office Complex and decontamination facility. A smaller 5KW portable generator will also be located on-site for portable electric power. A service entrance panel and distribution panel will be installed at the Office Trailer and connected to the generator. Service will then be routed to all other trailers and facilities, as needed. The location of the generator is shown in Drawing 799147-C1.

Potable water will be delivered to the site and maintained for the duration of the project. Portable toilets and a dumpster for general office waste will also be provided.

Telephone service will be provided by cellular mobile phones. Two separate lines/phones will be provided for the duration of the field

activities. Additionally, portable hand held radios will be utilized for on-site communications.

3.2.3 Support Zone

An office trailer and a mobile laboratory trailer will be set up to support the remediation effort. The location of the support facilities is shown in Drawing 799147-C1. A decontamination (decon)/change trailer will also be provided as discussed later. Additionally, the support zone will consist of Shelter 212 where miscellaneous tools and materials will be stored.

The office trailer will consist of a 40-foot trailer with offices at each end of the trailer. The trailer will be equipped with desks, filing cabinets, work tables, a fax machine, a copy machine, refrigerator, water cooler, and desk top computer with printer for analyzing data collected in the field. Field meetings and training will be conducted within the office trailer.

The mobile laboratory will be sized to accommodate all laboratory equipment. Soil samples will also be archived after analysis and stored in the trailer or a shelter for the duration of the project.

3.2.4 Contamination Reduction Zone

Located adjacent to the Office/Laboratory area are the decontamination facilities, for both personnel and equipment.

The Contamination Reduction Zone includes both the personnel decon/change trailer and equipment Decontamination (Decon) Pad. The personnel decon/change trailer will be located adjacent to Exclusion Zone and the "clean" support zone. The equipment Decon pad will be located directly adjacent to the support zone fencing, but within the Exclusion Zone. The contamination reduction zone located between the Exclusion Zone and the Support Zone will provide a buffer zone for the decontamination of personnel and equipment. This will ensure that, prior to exiting the exclusion work area and entering the “clean” area, all equipment can be decontaminated and verified clean. Potable water and electrical power will be provided.

All personnel and equipment exiting the Exclusion Zone will be surveyed in accordance with the HASP (Appendix A) and the Radiation Protection Plan (Appendix B). All PPE will be removed within this area and bagged for disposal with the excavated soil or surveyed for release.

Water from the decon areas will be collected in a sump and used for dust control for the soil excavation and stockpiles areas where the soil is suspected to be above the 8 pCi/g cleanup goal. Prior to

use, this water will be filtered through a particulate filter and sampled for radionuclide analysis by the on site laboratory. Water used for dust control will be below 200 pCi/L Pu 239/240. Water that is above 200 pCi/L will be held on-site and treated as radioactive material. Water below 15 pCi/L Pu 239/240 may be disposed to a sanitary sewer.

3.2.5 Exclusion Zone

The Exclusion Zone is the area where all excavation and dismantlement activities are to occur. Entrance into the Exclusion Zone will be through a chain-link gate. The Site Preparation/Layout Plan (Drawing 799147-C1) shows the Exclusion Zone in relation to the Office/Lab area and the Decon area. Entrance into the Exclusion Zone will be restricted to only trained personnel or authorized personnel who are continuously escorted by a trained individual. All persons entering the Exclusion Zone must wear appropriate safety attire and abide by the HASP and related Radiation Work Permits (RWPs). Exiting from the Exclusion Zone will only be through areas designated in the HASP. The Exclusion Zone is delineated either by the chain linked or the silt fence and the appropriate signage.

3.3 Site Preparation

3.3.1 Initial Radiological Surveys and Sampling

3.3.1.1 Exclusion Zone Surveys

Prior to any field activities within the exclusion zone, an initial walkover radiological survey will be conducted to determine the boundaries of the soil excavation and validate that the zone delineated by the previous survey is consistent with present conditions.

3.3.1.2 Transportation Route and Rail Spur Surveys

Prior to the construction of the rail spur, baseline soil samples will be obtained along the entire truck transport route and at the rail-loading spur. Surface soil samples will be collected approximately every 1/8-mile along the transport route and samples will also be collected around the rail car loading area. Samples will be taken within the road on the unpaved portion of the transportation route and directly adjacent to paved portions of the route. Fixed-point (static) surveys will also be performed at each sample location using a FIDLER and an alpha contamination monitor.

These baseline soil samples will be analyzed prior to commencing transportation of radioactive waste on Fort Dix or NAES Lakehurst property. The soil sample and survey results will be analyzed and the results compared to post-operational soil samples and surveys taken at the conclusion of the project. Details of sampling and final status surveys for the truck transportation route and railhead areas are contained in Appendix C, Sampling and Analysis Plan.

3.3.2 Land Surveying

A New Jersey Registered Land Surveyor will conduct a topographic survey of the excavation area and vicinity. The surveyor will also perform the following surveys prior to other excavation activities:

- Survey the excavation boundaries as per new walk-over survey,
- Confirm the locations of general site features such as shelter locations, drainage swale, concrete pads, communication bunkers as shown on existing site map,
- Establish bench marks in vicinity of the excavation limits for additional surveying during excavation activities,
- Locate the sample grid nodes from previous Site Characterization Report, and
- Provide survey of drainage area surrounding the planned excavation areas.

The land surveyor will provide digital maps in AutoCAD ® Release 14 format and in New Jersey State Planner Coordinate System.

3.3.3 Environmental Control Systems and Monitoring Program

Prior to excavation activities and throughout the remedial action, environmental controls will be implemented to control erosion and sedimentation, manage storm water runoff, and minimize dust emissions.

3.3.3.1 Erosion and Sedimentation Controls

Prior to performing any intrusive work at the site, erosion and sedimentation controls shall be installed as required. Silt fencing will be utilized to minimize the transport of sediment in storm water runoff. Drawing 799147-C2 indicates the proposed location for silt fence installation. Silt fence shall be installed down-slope of all areas where intrusive work is to occur and down-slope of all soil stockpile areas. Silt fence shall be

installed and maintained in active work areas and down-slope of re-vegetated areas until an adequate stand of vegetation is established. The silt fence will be installed by advancing an anchor trench using a Ditch Witch ® trencher. The silt fence will then be manually installed in the trench.

Erosion control details are shown on Drawing 799147-C2 and 799147-B4 (Appendix F).

3.3.3.2 Storm Water Runoff

Prior to any intrusive work, all storm water runoff will flow off-site via the existing swales and ditches, as presently occurs. In order to prevent surface runoff water entering an active excavation within the Exclusion Zone, soil berms and swales will be installed by mounding the existing site soil at the topographic high point (up slope) of the work area. Excavating one bucket-width of soil to construct a swale and mounding this soil down slope of the swale to form a berm, will divert uncontaminated water from entering excavations.

Storm water runoff from areas outside of the excavated areas will not be collected, but shall be diverted from excavation areas, to the extent possible, utilizing drainage ditches and diversion berms.

Storm water accumulation will be monitored on a daily basis to assure that no storm water leaves a controlled area. (Analytical method capable of detecting plutonium and americium must be used to verify that the water meets the effluent release criteria of Title 10 CFR Part 20, App. B.) If it is apparent that the storm water accumulating in a swale or ditch becomes excessive, the water will be pumped to a temporary storage tank located near the decontamination pad for use as dust control in the Exclusion Zone. Also see Section 3.4.4.7, Excavation Storm Water Control.

3.3.3.3 Dust Suppression

Throughout construction, all exposed areas within the exclusion zone (stockpiles, Shelter 204, excavations) will be watered as needed to minimize dust emissions. Water for dust suppression within areas exceeding the cleanup criteria will be obtained from the storm water runoff, the Decon pad, or from the drummed decon water in Shelter 208. Water will be supplemented with an outside source, if necessary.

Water for dust suppression in all other areas will be obtained off-site and stored in a mobile potable water tank located near the proposed decontamination trailer. Dust suppression will occur, as needed, based on visual observation and air monitoring results. A temporary storage tank will be used to store dust suppression water in the Exclusion Zone. A water truck will also be present on-site at all times.

Dust will be controlled on the truck route and at the rail transfer area by controlling the speed of vehicles and by applying water for dust suppression, as needed.

3.3.3.4. Perimeter Radiological Airborne Monitoring

Several air samplers will be installed at locations around the perimeter of the BOMARC Site and one air sampler will be located at the railhead area, in order to assess the levels of airborne radioactive particulates that have potential for migrating off-site. Details on the location and operation of the air samplers and air monitoring are specified in the Radiation Protection Plan (Appendix B).

Filters will remove particulates from the air pumped through each sampler. The filters will be analyzed in accordance with Radiation Protection Plan (Appendix B). If the radiation levels detected are significant as defined by the Sampling and Analysis Plan (SAP) (Appendix C), further laboratory analysis will be conducted and work will stop until resolution. If radioisotope activities in the air samples are deemed excessive, then corrective steps will be taken immediately to further reduce dust levels in the work area. The radiological airborne contaminant monitoring will be under the direct supervision of the on-site CHP, and will be executed by HP technicians with assistance from the Sample Coordinator.

3.3.3.5 Environmentally Sensitive Areas

Botanical surveys of the BOMARC facility have been conducted in the past. During a survey conducted in 1991 two New Jersey listed species of plants; Greene's rush and sickle-leaved golden aster were identified. However during subsequent site visits, no threatened or endangered plants were observed at the remediation site.

As an added precaution, a survey of the excavation and surrounding areas will be conducted to confirm the

absence of these plants. If detected, measures will be taken (caution tape, barricades, and personnel training) to minimize disturbance to the plants. The same is true for the borrow fill area.

3.3.4 Decontamination Pad

The vehicle/equipment decontamination pad located within the Exclusion Zone will be constructed using 40-mil liner and wooden posts. Splash walls will be constructed along both sides of the pad using lumber and corrugated sheeting. A power washer will be provided for decontamination, if needed, and a sump pit will be installed for the removal of the water from the Decon pad. Water from the Decon pad will be used for dust suppression of >8 pCi/g Pu contaminated soil only.

3.3.5 Excavation Soil Stockpile Areas

Excavation stockpile areas will be designated for both contaminated (>8 pCi/g Pu) and clean soil (<8 pCi/g Pu) as determined by the radiological surveying during excavation activities. All excavated soil that is contaminated based on the survey results will be transferred to the contaminated soil stockpile area via a front-end loader. The contaminated stockpiles are located near Shelters 102 and 104. The soil stockpiles will be lined on the bottom with 10-mil plastic and on the sides with plastic sheeting and sandbags. Contaminated stockpiles will be limited to 500 cubic yards each. The total contaminated stockpile size will not exceed 1,000 cubic yards during the course of the excavation. The Hazardous Material Broker will coordinate with the Construction Manager and the transport subcontractor for rail shipments of the contaminated soil in order to minimize the amount of soil stockpiled on the BOMARC site. Soil sampling and surveying of the stockpiles will be conducted periodically as required by the disposal facility, the CHP, or the Construction Manager.

The clean stockpile (<8 pCi/g) will be staged on the adjoining row of shelters due to space limitations near the excavation area. The stockpile will be lined similar to the contaminated stockpile. Clean soil will be generated during the excavation due to sloping requirements for access to deeper contaminated soil. In order to remove and transfer clean soil, a “clean work” backhoe will be used to reduce the possibility of cross-contamination.

Clean soil stockpiles will be limited to 500 cubic yards each. As each 500 cubic yard limit is reached, the stockpile will be surveyed and sampled to assess the quality of each stockpile. Soil sampling requirements are documented in the Sampling and Analysis Plan (Appendix C). The soil will be used as backfill at the end of the project after the completion and approval of the Final Status Survey.

The locations of the soil stockpiles are depicted on Drawing 799147-C1.

3.3.6 Shelter Debris Stockpile Areas

The contaminated shelter debris stockpile area consists of debris generated during the dismantlement of the Shelter 204 and the selective demolition of Shelters 202 and 206. As the shelters are dismantled, debris in excess of the release criteria will be segregated and transferred to this stockpile for transport via the intermodal containers to Envirocare of Utah. Debris from Shelters 202, 204, and 206 with contamination below release limits will be stored on site at the “clean” debris stockpile as designated by the AF.

3.3.7 Transportation Container Load-out Area

The container load-out area is located at the contaminated soil stockpiles near Shelters 102 and 104. The load-out area is where the transportation containers will be loaded with contaminated soil and debris by a front-end loader. The location of the load-out area is depicted on Drawing 799147-C1.

3.4 Site Remediation Operations

This section discusses the various procedures, equipment, and personnel to be used in the dismantlement of Shelter 204 and excavation of the radiologically contaminated soil. The general scope of work includes the removal and off-site disposal of radioactive contaminated soil and building debris.

Excavation of the soil is anticipated to occur within the main excavation area moving from the east to the west. The general location of the excavation is depicted in Drawing 799147-C1 and C2.

During the excavation and demolition process, material will be designated to one of five different categories:

(1) Contaminated soil with activity >8 pCi/g Pu will be segregated for off-site disposal,
(2) Soil with activity <8 pCi/g Pu will be stockpiled on site for later use as backfill,

(3) Shelter debris which exceeds the release criteria will be segregated for off-site disposal,
(4) Shelter Debris which is below the release criteria will be stockpiled on-site for disposal by others, and
(5) Soil from the launch pit in Shelter 204 will be segregated from other waste for additional sampling. It will be disposed of off-site.

Segregation of the soil and building debris during excavation and dismantlement activities will be based on radiological surveys and on-site sampling results.

3.4.1 Radiological Surveys

Radiological surveys will be performed during excavation and dismantlement activities to ensure compliance with appropriate regulatory guidelines with respect to release from the site, to determine excavation boundaries, and to document compliance with the cleanup goals.

Several different types of radiological surveys will be performed during the course of this project:

(1) A walk-over survey of the perimeter of the excavation will be conducted prior to the start of remedial activities, and during the excavation activities,

(2) Shelter 204 surveys prior to and during dismantlement,

(3) Routine surveys of roads, load-out areas, decon pads, and soil stockpile areas during remedial activities to ensure that radioactive materials are not being spilled or dispersed around the site as a result of the remedial activities,

(4) Release surveys of equipment, materials, tools, and personnel which will be exiting the Exclusion Zone, and

(5) Final Status Survey (FSS) of the site following remedial activities, prior to backfilling.

3.4.2 Personnel Surveys

Prior to leaving the Exclusion Zone, all personnel will survey for contamination using hand held radiological meters, which is commonly called “frisking.” Contamination surveys will be conducted within the Contamination Reduction Zone prior to entering the support zone. Details regarding personnel monitoring are presented in the HASP (Appendix A) and the Radiation Protection Plan (Appendix B).

As personnel leave the Exclusion Zone, coveralls, gloves, shoe covers, and other used personal protective equipment (PPE) will be discarded within the CRZ, unless the items are surveyed and meet the release limits (e.g., respirators). Items discarded in the CRZ will be disposed of in accordance with the Waste Management, Transportation and Disposal Plan (Appendix D).

3.4.3. Shelter 204 Dismantlement

The scope of work for this area includes the complete dismantlement of Shelter 204 and appurtenant structures and the loading into transportation containers a total of approximately 439 cubic yards of contaminated waste. The structures to be dismantled include Shelter 204, the launch and control pits, and two utility bunkers located in front of the shelter. Safety will be a major concern during dismantlement activities at Shelter 204.

3.4.3.1 Sediment Removal

The sediments in the launch pit will be removed using a mini-excavator. The remaining small amounts of sediments will be removed by hand tools and HEPA vacuum cleaner. Since testing of the sediments in the pit showed detectable lead concentrations, this material will be segregated from other soil, and analyzed for lead. If analytical results indicate lead concentrations below 5 mg/l, the soil will be transported with other soil to Envirocare. However, if soil contains lead concentrations equal to or greater than 5 mg/l, the soil will remain segregated for later transport to Envirocare as hazardous or mixed waste.

Likewise, suspect lead based paint covered materials will also be sampled to verify the absence of lead concentrations in excess of the TCLP limit of 5 mg/l. However, the Site Characterization Report indicated that the majority of the paints used in the shelter for fixing contaminants in-place had faded and were no longer present.

3.4.3.2 Decontamination

As a means of controlling radiological contamination, removable contamination will be addressed first. Based on the building survey results, the exposed building interior surfaces will be cleaned using a HEPA vacuum. The waste will be contained in bags and commingled with other material for transportation to Envirocare. Shelter

areas with higher radiological contamination or areas that can not be decontaminated will be marked for removal and off-site disposal. Fixed surface contamination will be removed, where possible, using standard decontamination techniques such as using abrasive materials or hand tools (grinders, chisels, etc.).

3.4.3.3 Shelter Demolition

Based on the 1998 Final Characterization Report, the contractor estimated that 439 cubic yards of building debris would require disposal. Some areas of the shelter could not be surveyed and therefore were not decontaminated. Areas that were not decontaminated or where decontamination efforts fail, will be physically removed from the structure and stockpiled as radioactive waste for off-site disposal. Removed sections will be cut into manageable pieces based on transportation or disposal facility requirements. Load bearing beams that require removal will be evaluated on a case by case basis.

After residual contamination and contaminated material has been removed to below acceptable levels, the remaining structure will be demolished. The roof will be removed by cutting supporting members using a shear mounted on a track hoe and allowed to fall to the ground. The roof will then be cut into sections, verified clean, and transferred to an on-site clean debris stockpile for disposal by others.

After the removal of the roof, the walls will be demolished in the same manner until the entire structure has been removed and transferred to the appropriate stockpile.

After the removal of the entire structure, the concrete floor, and launch pit will be removed using a hydraulic hammer mounted on a track hoe. The surfaces of non-porous materials will be surveyed for residual contamination and will be released if the contamination levels are less than the limits for surface contamination in Table 3.2. For concrete, surface samples (from the top few inches) will also be obtained and analyzed at the off-site lab to ensure that no volumetric contamination is present above the 8 pCi/g limit for Pu. Debris exceeding the release criteria will be segregated as radioactive debris and transported off-site for disposal.

During concrete removal and sampling activities within the shelter, a fine water spray will be used to reduce airborne contaminants.

3.4.4 Soil Remediation

3.4.4.1 Excavation Safety

The excavation activities discussed in this section can be conducted only if proper procedures and practices are instituted to ensure the health and safety of personnel from both radiological exposure and physical and/or mechanical hazards. A site specific HASP (Appendix A) has been developed in accordance with the OSHA Safety and Health Standards 29 CFR 1910.120, 29 CFR 1926, and the Hazard Communication Standard 29 CFR 1910.1200. The purpose of the Health and Safety Plan is to establish safe procedures and practices for the personnel engaged in field activities associated with the Remedial Action.

3.4.4.2 Soil Excavation and Segregation

The scope of work for the remediation includes the excavation of soil and other materials and loading into transportation containers for disposal at a licensed disposal site. Based on the June 1998 Final Site Characterization Report, the contractor estimated approximately 8,000 to 12,500 cubic yards of soil and concrete will require disposal. Most of the waste will contain plutonium contamination less than 2000 pCi/g. Approximately 200 cubic yards of soil is estimated to have activity greater than 2000 pCi/g. The soil and concrete extend from the missile shelter area to the drainage ditch. A localized area located across Route 539 and along the drainage ditch will also require excavating down to four feet. The contaminated soil in front of Shelter 204 will be addressed first during the excavation phase of the project. After completion, the contaminated soil along the drainage ditch will be removed followed by the removal of the contaminated soil across Route 539.

3.4.4.3 Shelter 202 and 206 Demolition

Due to the anticipated depth of the excavation near Shelters 202 and 206, selective demolition will be

accomplished. Because these shelters are no longer in use, the front bay (20 feet) of each shelter will be removed in order to gain access to the load bearing soil adjacent to each shelter. This phase of the demolition work will be completed concurrently with the decontamination of Shelter 204.

3.4.4.4 Main Excavation

The main excavation for the removal of the contaminated soil is located adjacent to Shelters 202, 204, and 206. Based on the Site Characterization Report, contaminated soil above the 8 pCi/g release level is present up to a depth of 24 feet below existing land surface. The volume of contaminated soil and concrete near Shelter 204, including the concrete apron, is approximately 7,000 cubic yards. However, to gain access to deeper contamination or for the purposes of sloping the excavation walls, approximately 4,500 cubic yards of clean soil will also be temporarily removed.

Based on historical investigation, the depth to groundwater at the Shelter 204 area is approximately 50 feet. Therefore, groundwater should not be encountered during excavation activities.

3.4.4.4.1 General Excavation Procedures

Excavation of radiologically contaminated soil will commence after the area of excavation has been delineated on the existing ground surface and Shelter 204 has been dismantled. The current delineated area of > 8 pCi/g Pu-239/240 soil is presented on Drawing 799147-C1 and C2.

To gain access to the contaminated soil in front of Shelter 204, the concrete cover will be demolished using a hydraulic hammer mounted on an excavator. Concrete debris will be screened and transferred to the appropriate stockpile. After the entire concrete section has been removed, excavation of the soil will commence.

The delineation of the perimeter of the excavation area will be based on a 5-meter grid system. After the delineation of the perimeter, a hydraulic excavator will excavate the >8 pCi/g soil in two-foot vertical lifts.

The excavator will place the >8 pCi/g soil either into a front-end loader or on to the side of the excavation trench. The loader will transport the >8 pCi/g soil to the staging area depicted in Drawing 799147-C1. The front-end loader will utilize the same path to and from the stockpile to minimize the spreading of any contamination.

The front-end loader will then load the>8 pCi/g soil into a steel intermodal container at the staging area. Soils greater than 2,000 pCi/g will be loaded into a container that meets DOT IP-2 specifications.

After a 2-foot lift of the excavation has been removed, another survey will be conducted at the perimeter of the excavation for the delineation of the next 2-foot lift. Along with surveying, perimeter soil samples will be collected for analysis by the on-site laboratory. The excavation work, surveying, and sampling will continue until sample results indicate that no further activity above the 8 pCi/g limit is present.

Excavation of clean soil in order to access contaminated soil or to maintain appropriate excavation slopes will proceed in the same manner as excavation of >8 pCi/g soil. Clean soil will be excavated with a dedicated “clean” excavator in two-foot lifts and transferred by a dedicated “clean” loader to the clean soil stockpile area. The path used for transportation of clean soil through the excavation area will be located within soil areas that are <8 pCi/g. The loader will dump the clean soil at the stockpile area, where they will be held until needed for back filling operations.

Dust will be reduced primarily through the use of controlled spraying and watering. Water used for dust control will include decontamination water and storm water run-off for the >8 pCi/g soil areas, and potable water for the <8 pCi/g soil areas. Appropriate measures to control storm water and sediment will be implemented throughout the time that soil is stockpiled. These measures will consist of the installation and maintenance of a silt fence and other erosion control devices around the entire perimeter, as required.

Final Status Surveying will be performed after the excavation activities, when an area has been determined to be clean based on the delineation sampling, and when no further excavating is required.

3.4.4.4.2 Shelter 204 Bunker Removal

The Utility bunkers in front of Shelter 204 will be removed during the main excavation activities. After exposing all sides, the bunkers will be broken in place into sections using a hydraulic hammer on the excavator. After sectioning, the pieces will be removed from the excavation and placed on plastic sheeting next to the excavation area. The concrete pieces will then be surveyed and decontaminated similar to Shelter 204. A temporary plastic cover may be erected around the decontamination area and may be placed under negative vacuum with HEPA filtration. After decontamination efforts, the concrete pieces will be re-surveyed and relocated to the appropriate stockpile (contaminated or clean). The temporary decontamination area will be located far enough from Shelter 204 for excavation activities to resume.

3.4.4.5 Drainage Ditch Excavation

After the completion of the main excavation, the drainage ditch contamination will be removed. This portion of the site is down slope of the main excavation area, is less contaminated, and requires a shallower excavation. By excavating this section last, any contamination that might have spread down slope of the main excavation will now be removed during the removal effort at the ditch area.

The excavation will proceed from the north to the south. Perimeter surveying, sampling, and excavating will be conducted similar to the main excavation. However, the excavation will be approximately two to four feet in depth. Contaminated soil will be transferred to the stockpile area for off-site transportation. Due to the configuration and depth of the contamination in this area, the quantity of clean soil removed will be minimal.

Surface runoff during storm events will be diverted from the excavated areas through the use of swales and berms. The location of the swales is depicted in Figure 799147-C2. The excavation area will be lined with plastic sheeting in the event that a storm event is forecasted. Surface water within the excavated area will be pumped to a temporary storage tank near the decontamination pad.

Immediately following the excavation at the drainage ditch, a Final Status Survey (FSS) will be conducted as per the Sampling and Analysis Plan.

3.4.4.6 Route 539 Soil Excavation

One soil sample collected across Route 539 along the drainage swale contained Pu 239/240 concentrations above the release limit. The estimated depth of contamination is 4 feet and the volume of contaminated soil is approximately 100 cubic yards.

Perimeter surveying and soil sampling will be collected from this area based on 5-meter grid system and the area requiring excavation will be accurately delineated.

The excavation will be conducted using a small backhoe to reduce the amount of vegetation and trees requiring clearing to gain access to the excavation area.

A limited botanical survey of the area and the access path will be conducted to verify the absence of endangered plants prior to clearing the area. The surveyor will also document the types of plants and trees present for replanting after the excavation. The path to the excavation will be determined based on the least amount of disturbance to the vegetation. All cleared trees and bushes will be stockpiled to the side in a nearby area. The area will then be cordoned off using ropes and signs indicating that the area is a Radiological Control Area.

A backhoe will excavate the delineated area after the completion of the survey and sampling. Excavated soil will be removed and loaded directly into a steel intermodal container that is placed on a truck, as outlined in Section 3.4.6.

The duration of work for this stage is anticipated to be 1-2 days. Because of the location of the excavation (within the swale), the excavation will be conducted when clear weather is forecast to avoid having to control run-off water entering the swale.

Immediately following the excavation activities, a Final Status Survey (FSS) will be conducted along the drainage area across Route 539. The excavation will be lined as described in Section 3.4.4.7.

After review and approval of the FSS results, the excavation will be immediately back-filled with borrow material, and the area re-graded to original conditions based on the topographic survey of the area conducted at the start of the project. Tree seedlings, plants and bushes will be planted within the disturbed areas based on the initial botanical survey.

3.4.4.7 Excavation Storm Water Control

As described in Section 3.3.3, swales and berms will be constructed and maintained during the excavation activities to divert surface runoff from entering the excavation pit.

In addition, the excavation will be covered with plastic sheeting at the end of each day to prevent precipitation from entering the excavation. The plastic sheeting will be draped over the excavation sidewalls and placed over the floor of the excavation. The liner will be secured with sandbags at the outer limits of the liner and set in place either manually or with the excavator at regular intervals within the excavation. The liner will be disposed with other remedial waste at the end of the project.

3.4.4.8 Excavation Soil Management

The stockpile areas are dedicated to the types of materials they are storing. As a result of the surveying and sampling effort, only soil and debris identified as contaminated will be transported for off-site disposal. As a result of the segregating efforts, the site will contain five separate types of dedicated stockpiles including:

-Contaminated soil for off-site disposal,
-Contaminated debris for off-site disposal,
-Contaminated debris from shelter 204 with potential for lead contamination
-Clean soil stockpile,
-Clean debris stockpile

Each stockpile will be clearly marked with the type of material allowed.

As an extra precaution, all stockpiles will be staged on 10-mil plastic and will be covered with sheeting and sandbags when not in use. Sampling and surveying of the stockpiles will be conducted periodically at the discretion of the on-site CHP or as required by the

disposal facility. Additionally, the clean soil will be sampled to confirm soil contamination concentrations are < 8 pCi/g Pu, prior to using as backfill.

The maximum size of each of the stockpiles will be maintained at 500 cubic yards each to reduce the difficulties in covering and uncovering stockpiles. As soil stockpiles (clean and contaminated) reach the 500 cubic yard limit, a composite soil sample will be collected for analysis at the on-site laboratory. Composite samples will be collected in accordance with Appendix C, the Sampling and Analysis Plan.

3.4.4.9 Equipment

Several pieces of equipment will be required to conduct excavation activities. A brief description of each of these pieces of equipment and their intended use is provided below.

Hydraulic Excavator- A hydraulic excavator operates using the same principles as a backhoe, except at a larger scale. The hydraulic excavator will be of a track-mounted variety. The bucket to be used in excavation will be either an excavation bucket or a utility bucket. The standard bucket capacity is approximately 0.5 cubic yards for a 24-inch wide bucket and 0.75 cubic yard for a 36-inch wide bucket. Hydraulic excavators have a boom and stick assembly that can typically reach soil at ground level 25 to 35 feet away and can excavate to a depth of 20 feet. However, as depth increases, reach decreases and as reach increases, depth decreases. Depth and reach can be maximized by utilizing a high horsepower excavator (typically, higher horsepower equates to greater reach and depth) or by specifying a longer boom and stick assembly. Excavator attachments (hammer and shears) will also be utilized during demolition activities near Shelter 204.

Front -End Loader - A front-end loader is utilized in situations where a large volume of soil may need to be moved in one bucket. The front-end loader will be of the wheel-mounted variety. A wheel-mounted front-end loader can travel quickly between the stockpile soil and the location where containers are loaded. The bucket to be used for loading is called a general-purpose bucket. The standard bucket capacity is approximately 5.0 cubic yards for a 9 feet wide bucket and 7.5 cubic yards for a 12 feet wide bucket. The width of the machine varies from 8 feet to 11 feet.

Dozer - A dozer will be used during the backfilling operations for the spreading and compacting of the soil in the excavation. Once the soil within the excavation is 4 feet below the surface, the dozer can enter the excavation, and spread and compact the soil evenly throughout the excavation area.

Water Truck - A water truck will be required on-site to assist in the control of dust during remedial action. The truck will be used to control dust on the access road between the excavation and the load out area, within the excavation area during excavation and within the excavation during backfill operations. The water to be used for dust control will be obtained from storm water collection devices or from potable water sources, depending upon the area to be sprayed. Potable water will be used for all clean haul roads.

Crane – Cranes with sufficient capacity for the load being handled will be used at both the load-out area to load full intermodal containers onto the trucks and at the railhead area for loading intermodal containers onto the rail cars.

Forklift – A heavy-duty forklift may be used to position empty steel intermodal containers within the staging area, prior to loading with soil.

Truck – Flat bed trucks will be used to transport intermodal containers between the loading pad and the rail facility.

3.4.4.10 Personnel

Properly trained, experienced personnel will be required to implement excavation and dismantlement activities as discussed herein. All personnel will have proper training, certification or experience for the work tasks that they are assigned to perform, in addition to the project-specific training and qualifications.

Equipment operators will be utilized for hydraulic excavators, front-end loaders, forklifts, and cranes. The number of operators required would be dependent on the quantity of equipment and the task being completed. Operators will be required to comply with the PPE and radiological procedures established in the HASP.

Other experienced personnel will also be required to oversee or assist with activities in a non-operator

capacity. Spotters will be required to assist in the excavation and loading activities. After excavation is completed, they will spot loads for location and placement of backfill materials. Maintenance or general labor personnel will be utilized to clean up spills of contaminated soil or materials resulting from a spill or leak that occurs during transport to the load-out area or along the local transportation route. All personnel who perform decontamination tasks will receive training on the decontamination methods that will be used for the project. Finally, an excavation coordinator will be required to supervise all activities and to coordinate equipment and labor between several work areas.

During dismantlement of Shelter 204, personnel familiar with decontamination procedures and equipment will be utilized.

All decontamination, surveying, and sampling activities will be supported by a team of HP technicians under the direct supervision of the on-site CHP.

3.4.5 Existing Waste Disposal

Shelter 208 currently houses approximately 70 waste drums and an assortment of waste including coolers and boxes. This material was generated during characterization investigations previously conducted on-site. As part of the remedial effort, all waste containers will be removed, segregated, and loaded into the intermodal containers for off-site disposal. The waste contents of the drums may be co-mingled with other waste materials prior to placing the waste into intermodal containers. Prior to working with the drums, the drums and contents will be surveyed to determine radiation exposure levels and surface contamination levels.

There are approximately 29 drums containing water used in previous decontamination/sampling efforts. The water will be pumped from the drums into the contaminated water holding tank to be used for dust suppression during the excavation activities. Only areas exceeding the release criteria will be sprayed using this water. The empty drums will be crushed and added to the waste stream for offsite disposal.

Drums containing PPE, jars, and other miscellaneous items will be emptied and the waste added to an existing similar waste stream. The drums will be crushed and added to the waste stream. An inventory of the existing drums is presented in Table 3-1.

Table 3-1

Drum Log Summary - Shelter 208
Waste Disposal List

Drum Number	Overpack (Yes/No)	Description On Lid	Additional Description
D001	YES	202-CR PIT WATER	
D002	YES	202-CR PIT WATER	
D003	YES	202-CR PIT WATER	
D004	YES	202-CR PIT WATER	
D005	YES	204-POWER BUNKER WATER	
D006	YES	204-POWER BUNKER WATER	
D007	YES	204-POWER BUNKER WATER	
D008	YES	204-POWER BUNKER WATER	
D010	YES	204-POWER BUNKER WATER	
D011	YES	204-POWER BUNKER WATER	
D012	YES	204-COM BUNKER WATER	
D013	YES	204-COM BUNKER WATER	
D014	YES	204-COM BUNKER WATER	
D015	YES	204-COM BUNKER WATER	
D016	YES	204-COM BUNKER WATER	
D017	NO	NONE	Decon Water, Sample Equip.
D018	NO	DECON PAD WATER	
D019	NO	DECON PAD WATER	
D020	NO	DECON TRAILER WATER	
D021	NO	DECON TRAILER WASTE WATER	
D022	NO	DECON WASTE WATER	
D023	NO	DECON TRAILER WASTE WATER	
D024	NO	DECON TRAILER WASTE WATER	
D025	NO	DECON TRAILER WASTE WATER	
D026	NO	TRASH/PPE-ALUMINUM PANS 7/31/97	
D027	NO	PPE-7/31/97	
D028	NO	TRASH	
D029	NO	PPE/TRASH 7/31/97	
D030	NO	PPE/PUMP HOSE 7/31/97	
D031	NO	TRASH	
D032	NO	TRASH	
D033	NO	TRASH	
D034	NO	TRASH	
D035	NO	SAMPLES	Radiological samples, Soil Trimmings, Radiological Trash
D036	NO	MARINELLI SAMPLES	
D037	YES	206-LAUNCH PIT	
D038	YES	206-LAUCNH PIT	
D039	YES	206-LAUCNH PIT	

Drum Number	Overpack (Yes/No)	Description On Lid	Additional Description
D040	NO	206-LAUNCH PIT TRASH & PUMP	
D041	NO	MARINELLI SAMPLES	
D042	NO	MARINELLI SAMPLES	
D043	NO	MARINELLI SAMPLES	
D044	NO	MARINELLI JARS/SAMPLE BAGS 8/7/97	
D045	NO	MARINELLI JARS 8/7/97	
D046	NO	DECON WATER	
D047	NO	MARINELLI JARS-LID IS NOT SECURED	Extra Soil Sample Material
D048	NO	EXTRA SOIL SAMPLE MATERIAL	
D049	NO	(NONE)	Extra Soil Sample Material
D050	NO	EXTRA SOIL SAMPLE MATERIAL	
D051	NO	DECON PAD PLASTIC	
D052	NO	DECON TRAILER WASTE WATER-FULL	
D053	NO	DECON WASTE TRAILER WATER	
D054	NO	DECON WATER	
D055	YES	TRASH	Overpack Drum Only
D056	NO	BARRINGER SAMPLES	
D057	NO	BARRINGER SAMPLES	
D058	NO	BARRINGER SAMPLES	
D059	NO	BARRINGER SAMPLES	
D060	NO	BARRINGER SAMPLES	
D061	NO	BARRINGER SAMPLES	
D062	NO	BARRINGER SAMPLES	
D063	NO	BARRINGER SAMPLES	
D064	NO	BARRINGER SAMPLES	
D065	NO	BARRINGER SAMPLES	
D066	NO	BARRINGER SAMPLES	
D067	NO	BARRINGER SAMPLES	
D068	NO	BARRINGER SAMPLES	
D069	NO	BARRINGER SAMPLES	
D070	NO	BARRINGER SAMPLES	
PALLET	N/A	N/A	55 BOXES

3.4.6 Load-Out and Transport to Rail Facility

The Construction Manager is responsible for loading of waste material on to trucks at the BOMARC excavation site and for transportation to the rail transfer area All waste materials are brokered and manifested from the BOMARC excavation site.

The load-out staging area is located adjacent to the contaminated soil/debris stockpiles. Although the stockpiles are located within the Exclusion Zone, the truck used for the transport of the intermodal containers will be located outside the Exclusion Zone for contamination control.

Note: Trucks used to transport waste containers will remain at the BOMARC site during non-working hours, for the duration of the project, except for maintenance and repairs. If a truck is released from the BOMARC site for maintenance or repairs, it will be surveyed for contamination in accordance with the requirements in Appendix B. If contamination is found on a truck at levels greater than the limits in Table 3.2, the truck will be decontaminated before release.

3.4.6.1 Description of Containers

Steel containers that meet DOT shipping requirements will be used to package all radioactive waste materials, including concrete, steel, wood and other debris that result from dismantlement of structures and soil. Soil and debris less than 2,000 pCi/g will be packaged in strong tight steel intermodal containers. Soil and debris greater than 2,000 pCi/g will be packaged and shipped in containers that meet the DOT requirements for IP-2 packages. .

3.4.6.2 Inspections, Surveys, Decontamination, Sealing and Loading of Containers

After the containers have been filled with contaminated material, they will be sealed, inspected and cleaned of exterior loose material. Metal containers have a gasket and latches on the top closure that will be checked for proper seating to ensure a good seal. A thorough visual inspection of container closures and seals will be performed. If any defects are found in gaskets or if the top does not seat properly, foam sealant or caulk will be used to ensure a leak tight seal is achieved.

After the container is properly sealed in a manner to ensure that it is leak tight, the outer surface of the container will be wiped down to remove dirt and possible contamination. Each container will then have a tamper-evident seal attached in a manner that it will be evident if the container has been opened. Each tamper-evident seal will have a unique serial number that the broker will record on the shipping manifest.

Smears (swipes) will be obtained on the top, the bottom, and each of the four sides of the container. Smears for up to three locations (300 cm^2 total area) may be composited to save time. Smears will be counted in the field using an alpha/beta scintillation detector or gas flow proportional detector for the amount of time necessary to detect the alpha limit given in Table 3.2. In addition to smears, fixed readings will be obtained at six locations of the container, the truck, and the tires, in areas most likely to be contaminated. Fixed readings will be performed using a scintillation detector or gas flow proportional detector.

If contamination greater than the limits in Table 3.2 is detected, the container or the truck will be decontaminated until it is within acceptable limits. Truck and tire decontamination will normally involve removing and collecting any gross dirt and debris, then cleaning with a wet rag or scrubbing tool. The contractor will collect material removed for proper disposal. The contractor will keep the use of liquids to a minimum and will spread plastic as necessary to collect dirt and debris removed.

A heavy-duty crane, equipped with a dynamometer for measuring the weight of the package, will be used to move the clean containers from the exclusion area onto the truck for shipment. A record will be generated for each container, including a unique identifying number for each container, the weight of the container, the tamper-evident seal number, and the date loaded onto the truck.

A truck with a load capacity at least 20% greater than the weight to be loaded will be used for transportation. After loading, the truck driver will examine the placement of the containers to ensure that they are properly loaded and that containers are not damaged or leaking. The driver will then secure the containers on the truck using standard tie-downs.

The Broker will perform a final inspection of containers and vehicles prior to transporting to the rail transfer area.

3.4.6.3 Transportation of Containers to Railhead

Transportation of waste by trucks and rail car loading will normally take place during normal working hours (0700 to 1700), unless otherwise authorized by the Air Force Project Manager, the NAES Lakehurst designated point of contact, and the Fort Dix point of contact.

The truck will transport containers, using the designated transportation route, to the rail facility at NAES Lakehurst, New Jersey, approximately 9 miles from the site. See Drawing 799147-B3, for a depiction of the Transportation Route (Appendix F). No trucks used for transporting radioactive material will remain on NAES Lakehurst overnight.

An escort vehicle will follow the truck(s) along the route from the work area to the rail spur, with the driver observing the trucks/containers for leaks during transit. The trucks will travel at a safe speed based on the conditions of the road and weather, but normally less than 30 mph. The escort vehicle will be equipped with communications, such as a radio or cellular telephone, and a spill kit which will contain PPE, plastic sheeting, water for dust control, absorbent material, caution tape, rope, barricades, and a list of telephone numbers for key site contacts.

In the remote event that a spill or leak of radioactive material occurs along the transportation route, the escort will immediately notify the SSHO (or the Project Manager in his absence), the Air Force Project Manager, and the installation managers at NAES Lakehurst and Fort Dix, and then begin steps to prevent the spread of contamination. The SSHO or alternate will respond immediately to the spill location, with radiological instrumentation, and assume control of the situation. The Duratek Project Manager, the SSHO/CHP, the Air Force Project Manager, and the NAES Lakehurst or Fort Dix installation managers will assess the extent of contamination and together develop and agree on a clean-up plan. The escort vehicle and transport trucks are not to leave the area until properly surveyed and released. Any spills or leaks of radioactive material along the transportation route and at the rail loading area will be decontaminated until surface soil contamination concentrations are less than 1.0 pCi/g Pu 239/240. Soil

samples collected post-mitigation will be archived for potential evaluation by additional parties. Contaminated asphalt or other materials will be decontaminated to levels in Table 3.2 or removed. Resumption of waste transportation will require approval of the Air Force Project Manager and the NAES Lakehurst and Fort Dix installation managers.

At the rail spur location, the waste containers will be surveyed for removable and total contamination prior to unloading. At least six direct readings will be taken on the container (each side around the container top seal and two on the bottom of the container) using a hand-held survey meter. After direct surveys, at least two smears will be taken on the container (one near the top seal and one on the bottom) at the locations with the highest direct reading or the locations most likely to be contaminated. See below for actions to take if survey results exceed the limits in Table 3.2.

After surveys have been completed, the transport contractor for off-site disposal will use a crane to remove the container and place it into a rail car for shipment. A record will be generated for each container loaded onto a rail car, including container number, container weight, tamper-evident seal number and status, date loaded, and rail car unique identification number. Other information required for shipping will also be maintained, as discussed in the following section. After loading, no railcars containing radioactive material will remain on NAES Lakehurst for more than 48 hours.

After unloading the containers, the truck frame will be surveyed for removable and total contamination. At least two direct readings will be taken on the truck frame using a hand-held survey meter, at locations beneath the container. After direct surveys, at least one smear will be taken at the location with the highest direct reading or the location most likely to be contaminated.

If surveys of the container or the truck exceed the limits in Table 3.2, contact the Air Force Project Manager, the Fort Dix contact and the NAES Lakehurst Installation Manager. Any contamination greater than allowable limits will be decontaminated and then the container or truck will be resurveyed prior to further action. This process will be documented on appropriate forms. Any contaminated materials generated from decontamination will be packaged and returned to the BOMARC site.

After surveys are completed, the truck will return to the excavation for another load-out. This process will continue until excavation work is completed for the day.

The contractor will also conduct daily surveys of the truck loading area at the BOMARC site within the clean zone using a contamination survey meter to detect total activity.

If these surveys show contamination levels greater than the limits contained in Table 3.2, the Duratek project manager will notify the Air Force Project Manager, the NAES Lakehurst installation manager and the Fort Dix contact, and arrange for decontamination.

3.4.7 Manifesting, Transportation, and Disposal

Shipping manifests, instructions to the carrier, and advance shipment notification forms will be prepared, approved, and one copy each given to McGuire AFB and OSC representatives.

A separate set of forms will be prepared for each container. Waste characterization (profiling) as required by Envirocare has been conducted. However, radiological sampling and analysis of the soil being shipped will be ongoing during the remediation effort. The analysis data will be used to confirm or adjust the previous profile.

All waste materials will be properly packaged and labeled in accordance with the United States Department of Transportation Hazardous Materials Regulations contained in 49 CFR Parts 171 through 180. In addition, a unique identification number will be assigned to each intermodal container and each rail car to permit tracking of the waste from shipment through off-site disposal and receipt of the certificate of acceptance and disposal.

The exterior surfaces of the waste containers will be surveyed prior to shipment for external radiation and removable contamination levels to ensure compliance with DOT 49 CFR 173.441 and 173.443 and contamination limits in Table 3.2. If contamination is found on a waste container at levels greater than the limits in Table 3.2, contact the Air Force Project Manager, and the NAES Lakehurst installation manager. Any radioactive contamination greater than Table 3.2 allowable limits found on the exterior of waste containers will be decontaminated and then the container will be resurveyed prior to release for transportation. This process will be documented on appropriate forms. Any contaminated materials generated from decontamination will be packaged and returned to the BOMARC site.

All rail shipments will be completed under contract with a single transporter. The transporter will provide a daily report to include tracking information for all rail cars. All coordination and tracking of shipments will be through a single point of contact, irrespective of the "secondary" rail companies involved in car movements.

All radioactive waste materials will be disposed of at the Envirocare Facility located in Utah under their NRC Special Nuclear Material License. Details on waste manifestation, transportation, and disposal are provided in the Waste Management, Transportation and Disposal Plan (Appendix D).

3.4.8 Quality Control and Oversight

As excavation proceeds it will be necessary to document conditions prior to excavation activities, during excavation, after excavation, after backfilling and after final cover construction. Documentation will include, but not be limited to the following:

- Quantity of contaminated soil removed from excavation areas,
- Quantity of clean soil removed from excavation areas,
- Location of soil removed from excavation areas (using elevation and planar coordinates),
- Quantity of contaminated debris removed from Shelter 204.
- Quantity of clean debris removed from Shelters 202, 204, 206, and the bunkers.
- Soil sample locations, survey locations and associated results,
- Air monitoring results.
- Quantity and quality of backfill materials delivered and placed.
- Transportation documentation and tracking.

These activities will be documented by appropriate field personnel assigned to each task, and tracked by the on-site QA Officer.

3.4.9 Final Status Survey Sampling and Analysis

Final status survey sampling and analyses will be performed following excavation of soil >8 pCi/g Pu 239/240 materials and prior to backfilling, in accordance with the guidelines specified in NUREG 1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The Final Status Survey (FSS) design is presented in the Sampling and Analysis Plan (Appendix C).

The review process will determine whether the data demonstrates compliance with the cleanup goal (<8 pCi/g Pu 239/240). If not, the site will be evaluated for additional remediation at areas that fail to meet the criteria.

If the results demonstrate compliance, the results of the analysis along with FSS data will be presented to the Air Force for review and approval. After approval from the Air Force, the excavations will be back-filled.

As part of the final status surveys, after the truck transportation phase of the project has been completed, soil samples will be obtained along the truck transportation route and at the rail spur-loading site. The Sampling and Analysis Plan for the transportation route and rail loading area is described in detail in Attachment A to Appendix C. Soil samples will be sent to an off-site laboratory for analysis, and copies of the results will be provided to NAES Lakehurst and to Fort Dix. These samples will be archived to allow independent analysis by the Navy or the Army.

In conjunction with final soil samples, direct surveys will be performed adjacent to each soil sample location.

3.5 Back Filling and Site Restoration

Backfilling of the excavations will commence after the Final Status Survey sampling program has confirmed that soil containing >8 pCi/g Pu has been removed from individual survey units and the FSS has been approved by the Air Force. Following this sampling, the surveyor will perform a topographic survey to establish the final limits of excavation and volume of soil removed from the individual survey units.

The front-end loader used for loading of contaminated soil will be decontaminated. The front-end loader will then be used to transfer the clean soil back into the excavation. After all the clean soil has been returned into the excavation, clean backfill will be brought on-site. The area of this backfill material will be surveyed for the endangered plants noted in Section 3.3.3.5. Erosion control measures will also be installed at the Borrow Area.

Initially, backfilling will also be performed using the clean soil located at the clean soil stockpiles on-site. On-site sampling and analysis will be performed to confirm that all soil located at the clean soil stockpiles are less than 8 pCi/g Pu, prior to backfilling.

Backfilling of soil will be performed using native soil imported from the Pinelands area. To insure acceptance of imported fill materials before back filling commences, the imported fill will be analyzed for BTEX, TPH, and TCLP during the initial stages of the project. Imported soil will be sampled every 500 cubic yards.

The excavations will be back-filled by placing the materials in 12-inch lifts. For excavation less than 4 feet, the soil will be spread using a dozer. The material will be tracked in place with no further compaction. For excavation greater than 4 feet, backfill material will be placed, then spread

and tamped using an excavator. The top 4 feet will be spread and compacted using a dozer as discussed above. All areas will be back-filled to within 4 inches of existing grade. The top 4 inches will then be back-filled by loosely placing one lift of topsoil. The area will then be hydro-seeded.

3.6 On-Site Laboratory and Radiation Control Operations

An extensive monitoring, sampling, and on-site analytical program will be implemented in order to:

- Ensure that all contaminated soil materials exceeding the cleanup criteria are removed from the site,
- Minimize the volume of soil inadvertently removed from the site that is below the cleanup standards,
- Verify that all items leaving the radiologically controlled area are surveyed and meet the limits specified in Table 3.2,
- Ensure that quantities of airborne radioactivity at the boundary of the site are at or below acceptable levels,
- Verify that all shipping containers meet the DOT (49 CFR 173.421) radiological criteria and Table 3.2 limits for contamination before leaving the site,
- Monitor and verify that exposure of workers to external gamma radiation and airborne alpha emitters is within an acceptable limit and is as low as reasonably achievable (ALARA), and
- Confirm that the Site meets the cleanup requirements stated in the Project Scope-of-Work and the Record of Decision through a Final Status Survey.

The quantitative analytical data generated as a result of these activities will be sufficient in type, quantity, and quality such that the cleanup of the site is verified, minimization of exposure to on-site workers can be shown, and migration of radioactive materials to adjacent properties and roads is proven to be negligible. Each aspect of on-site monitoring, sample collection, and field laboratory operations including laboratory Data Quality Objectives are presented in the Sampling and Analysis Plan (Appendix C).

3.7 Supporting Operations

3.7.1 Health and Safety, and Radiation Protection

The HASP will be implemented to ensure both worker and public protection throughout the remediation effort. This plan establishes requirements in regard to medical surveillance, bioassays, PPE, air monitoring, stop work authority, restricted work areas, hazardous and radiation work permits, training requirements, emergency response and notifications, waste minimization and

pollution prevention. The provisions of this plan are mandatory for all on-site employees, including subcontractor employees.

The ALARA Program is a commitment on the part of the management of this project to closely monitor all exposures and seek methods or techniques to further reduce the radiation exposure personnel may receive. All reasonable efforts will be made to keep radiation exposures, as well as releases of radioactive material to unrestricted areas, to levels that are ALARA. Toward this end, several ALARA principles will be used:

- The CHP will have sufficient delegated authority to enforce regulations and administrative practices concerning any aspect of the Health and Safety Plan and the Radiation Protection Plan,
- Personnel will be trained in safety procedures and ALARA philosophies to a level commensurate with their work scope,
- Safety inspections will be conducted,
- Hazardous and Radiation Work Permits will be required, and
- Radiation exposures will be minimized where practical, by the use of time, distance, shielding, administrative controls and engineering controls as specified in 10 CFR 20.1101(b).

The CHP, as the site safety representative, in consultation with the PM and applicable Home Office Safety Professionals will establish environmental health and safety policies and conduct independent inspections of the implementation of those policies.

Access to the BOMARC Site will be controlled to protect workers from unnecessary radiation exposure and to minimize the potential for the spread of radiation. Each area will be divided into three zones:

Exclusion Zone - Actual areas of contamination. Represents area that has highest inhalation exposure potential and/or presents a high probability of skin contact.

Contamination Reduction Zone - Areas immediately surrounding the Exclusion Zone, including the personnel and equipment decontamination facilities.

Clean Zone - Areas outside the Contamination Reduction Zone where adverse exposure is unlikely.

Access to these areas will be controlled for people, vehicles, and equipment by fencing and posting the area, or by using other methods to prevent inadvertent entrance. Smoking, drinking, eating, or other activities that would enhance the transfer of

radionuclides into the human body will be prohibited within the Exclusion and Contamination Reduction Zones.

Air samples will be collected and analyzed in accordance with the Sampling and Analysis Plan. High or low volume samplers will typically be used for area monitoring. Data from the air samples will be used to assess releases due to excavation operations and rail car loading. Air sample filters will be analyzed for gross alpha and beta, and radioisotope identification, as needed, and quantified to ascertain the airborne radioactivity concentration.

Generally, soil remediation work at the site will be performed under Level D protection. Level C protection might be required for activities where the potential for air-borne particulates (in excess of the action level as specified in the HASP) exists. This includes decontamination of shelter 204, excavation of soil, movement of soils to and from storage piles, and soil material loading areas. Whenever possible, engineering controls, such as keeping contaminated soils and surfaces damp, will be used to prevent airborne contamination. If required, full-face, cartridge-type air purifying respirators will be utilized, as directed by the CHP.

3.7.2 Quality Control

The Sampling and Analysis Plan will be implemented and monitored to ensure that all sampling, surveying, and construction quality objectives are met.

The Site Quality Assurance Officer will work directly with the Project Manager and the Construction Manager and will be delegated authority to enforce the requirements and administrative practices concerning any aspect of the quality control requirements depicted in this Plan and its Appendices. A three-phase control process will be implemented which includes:

- Preparatory Phase Inspection - Review and document applicable requirements and verify that the necessary resources, conditions, and controls are in place,
- Initial Phase Inspection - Check and document preliminary work for compliance with procedures and plans, and
- Follow-Up Phase Inspection - On-Site monitoring and documentation of the practices and operations taking place and verifying continued compliance with the project requirements and applicable regulations. Outstanding and nonconforming items or practices will be identified, along with corrective measures.

Upon conclusion of a definable feature of work, a review will be completed to verify that all documentation is in order prior to close out and transfer of files to OSC.

3.7.3 Decontamination and Release Operations

All equipment exiting a radiologically controlled area will be decontaminated, if necessary and surveyed to demonstrate compliance with the limits provided in Table 3.2. The BOMARC Site limits are taken from NRC Regulatory Guide 1.86. Aspects of rail transportation will be regulated by DOT 49 CFR 173.421, in addition to the contamination limits in Table 3.2.

All equipment will be dedicated for single use for the duration of the project as practical and will remain within the Exclusion Zone at the main site until decontaminated, surveyed, and verified in conformance with release limits. Decontamination may be performed at any location if proper controls are implemented, as directed by Health Physics personnel. Controls will normally include actions such as covering the ground and collecting materials from decon operations for proper disposal.

Some equipment may need to be taken to the decontamination facility within the BOMARC Exclusion Zone, which is designed for performing various methods of decontamination. All contaminated equipment located in the Exclusion Zone will be dry brushed/scraped to remove gross material prior to transport to the site decon facility, in order to retain contamination within the Exclusion Zone. At the decon facility, the following sequence will normally be followed until the equipment contamination levels are acceptable:

- Dry wipes of affected areas,
- Hand cleaning with a wet rag or a scrubbing tool,
- Low pressure detergent wash with brushing,
- Low pressure wash (2,000 psi or less) until visibly clean
- High pressure wash (10,000 psi), and
- Sandblasting (only if required).

No solvents or materials will be used for decon that will create a hazardous or mixed waste. The use of non-hazardous solvents may be necessary to strip outer layers of porous rubber parts (e.g. tires). This procedure will only be used as a last resort. Equipment parts that cannot be readily decontaminated will be removed and disposed of as radioactive waste, in the same manner as contaminated soil material.

Table 3.2

Decontamination and Release Operations
Surface Contamination Guidelines

Radionuclides[b]	Allowable Total Residual Surface Contamination (dpm/100 cm^2)[a]		
	Average[bc]	Removable[d,f]	Maximum[d,e]
BOMARC Site *:			
Plutonium 239/240, Americium-241	100	20	300
BOMARC Site *:			
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission)	5,000 β-γ	1,000 β-γ	15,000 β-γ
* Limits apply to all items *except* those expected to enter NAES Lakehurst or Fort Dix property. For those items, see limits below.			
Trucks, waste containers, rail cars and other items entering NAES Lakehurst or Ft. Dix property: Plutonium 239/240, Americium-241	50	10	50
Trucks, waste containers, rail cars and other items entering NAES Lakehurst or Ft. Dix property: Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission)	2X BGD[g] β-γ	2X BGD β-γ	2X BGD β-γ

[a] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[b] Where surface contamination by both alpha-and beta-gamma-emitting radionuclides exists, the limits established for alpha-and beta-gamma-emitting radionuclides should apply independently.

[c] Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such object.

[d] The average and maximum dose rate associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

[e] The maximum contamination level applies to an area of not more than 100 cm^2.

[f] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less then 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. The numbers in this column are maximum amounts.

[g] BGD refers to the mean background value for the instrument being used. The mean background will be established and background will be checked at the beginning of each day that an instrument is used.

3.7.4 Personnel, Equipment, and Facilities Demobilization

At the conclusion of remedial activities, the Project will demobilize from the BOMARC site. All equipment will have been decontaminated, tested and cleared in accordance with the Radiation Protection Plan (Appendix B). Decontamination and testing details are provided in the HASP (Appendix A) and Sampling and Analysis Plan (Appendix C).

Additionally, final radiological surveys of roads and decontamination facilities will be performed to meet the requirements of the Radiation Protection Plan. All records, including all post work submittals, will be submitted to the OSC.

3.8 Project Reporting

Throughout the execution of activities on the site, Daily and Monthly Reports will be prepared and distributed to Air Force, Navy, and Army personnel (as indicated on the report forms), electronically where possible.

3.8.1 Daily Reports as a minimum will provide the following:

- Personnel on Site, by Contractor
- Major Equipment on Site
- Work Performed
- Problems Encountered
- Safety Issues

3.8.2 Monthly Reports as a minimum will provide the following:

- Narrative of Work Performed during report month
- Narrative for Work Expectations for the pursuant month
- Updated Project Schedule by Activity
- Scheduled Percentage Complete
- Actual Percentage Work Completed
- Safety Meeting Topic and Presenter
- Encountered Problems and Resolutions

Examples of the daily and monthly report forms are included in Appendix G.

3.9 Final Report

A report of the site activities will be prepared after all work activities have been completed and after all documentation and data for the project is completed. The report will present the results of remediation sampling, volumes of soil excavated, volumes of soil transported for off-site disposal, and the results of the final status survey. All supporting documentation from the sampling, including on-site laboratory reports, off-site laboratory reports, survey records, transportation records, and disposal records will be included in the report.

A draft report (5 copies) will first be sent to OSC for OSC and Air Force review. After comments are received, a final draft will be prepared and sent to OSC and the Air Force for review distribution. The final draft report will be distributed by the Air Force to the Navy (2 copies), Army (2 copies), NJDEP, and US EPA. The final version of the report will be prepared after all comments have been resolved, and distributed by the Air Force to the Navy, Army, NJDEP, US EPA and made available in a public Information Repository.

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APPENDIX A

SITE HEALTH AND SAFETY PLAN (HASP)

APPENDIX B

RADIATION PROTECTION PLAN

APPENDIX C

SAMPLING AND ANALYSIS PLAN

APPENDIX D

WASTE MANAGEMENT, TRANSPORTATION AND DISPOSAL PLAN

APPENDIX E

PROJECT SCHEDULE

APPENDIX F

DRAWINGS

APPENDIX G

REPORTS/FORMS